

Mechanisms of uranium accumulation in roots of *Tamarix*

L. RODRIGUEZ-FREIRE^{1*}, C. DEVORE², E. EL HAYEK³,
A.M. ALI⁴, J.M. CERRATO⁵

¹Department of Civil and Environmental Engineering, New Jersey Institute of Technology, Colton Hall 200, Newark, New Jersey, 07102, United States (*correspondence:

lrfreire@njit.edu)

²Department of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, New Mexico 87131, United States (cdevore@unm.edu)

³Department of Chemistry, MSC03 2060, University of New Mexico, Albuquerque, New Mexico 87131, United States (elhayek@unm.edu)

⁴Department of Earth and Planetary Sciences, MSC03 2040, University of New Mexico, Albuquerque, New Mexico 87131, United States (mehdiali@unm.edu)

⁵Department of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, New Mexico 87131, United States (jcerrato@unm.edu)

We investigated the uptake of uranium (U) by *Tamarix* (aka Salt Cedars) growing along the Rio Paguete, which flows throughout the Jackpile Mine, an abandoned U mine near the vicinity of two villages of the Pueblo de Laguna, New Mexico. The U concentration in this river water ranged from 35-770 µg/L, but the measured uranium concentration in the sediments was low (1-5 mg/kg). Accumulation of U ranging from 10.8 – 58.9 mg/kg was detected in the roots of collected from the field, while the U concentration in shoots and leafs ranged from 0.6 – 3.1 mg/kg. Synchrotron-based micro X-ray fluorescence analysis of the plant roots indicates that the U accumulation occurs in the cortex of the root. The mechanisms for U accumulation in the roots of *Tamarix* were further investigated in controlled-laboratory experiments where the roots were exposed to a solution containing 100 µM U. Microscopic and spectroscopic analyses detected U precipitation in the root cell walls near the xylems of the roots. Additionally, needle-like U-P nanocrystals were found entrapped inside the cells. This preferable binding of U to the root cell walls may explain the U retention in the roots of *Tamarix* and the limited translocation observed in the shoots and leafs of the samples collected from the field. This work provides a unique perspective of the processes affecting the accumulation of U inside the roots of field-grown plants, which can inform exposure assessment and phytoremediation strategies.